

GME TO THE MOON



A quantitative analysis of  **wallstreetbets** [Join](#)
[r/wallstreetbets](#)

By Atri Bhattacharyya, Aurel Maeder, Ludovica Schaerf

85 Comments

Award

Share

Save

829

Outline

- Introduction
- Goals
- Data
- Network Analysis
- Inferenze
- Conclusion
- Who did what
- Lessons learned

133 Comments

Award

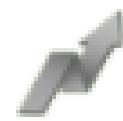
Share

Save

...

Posted by u/

4 hours ago



r/wallstreetbets · Posted by

12 days ago

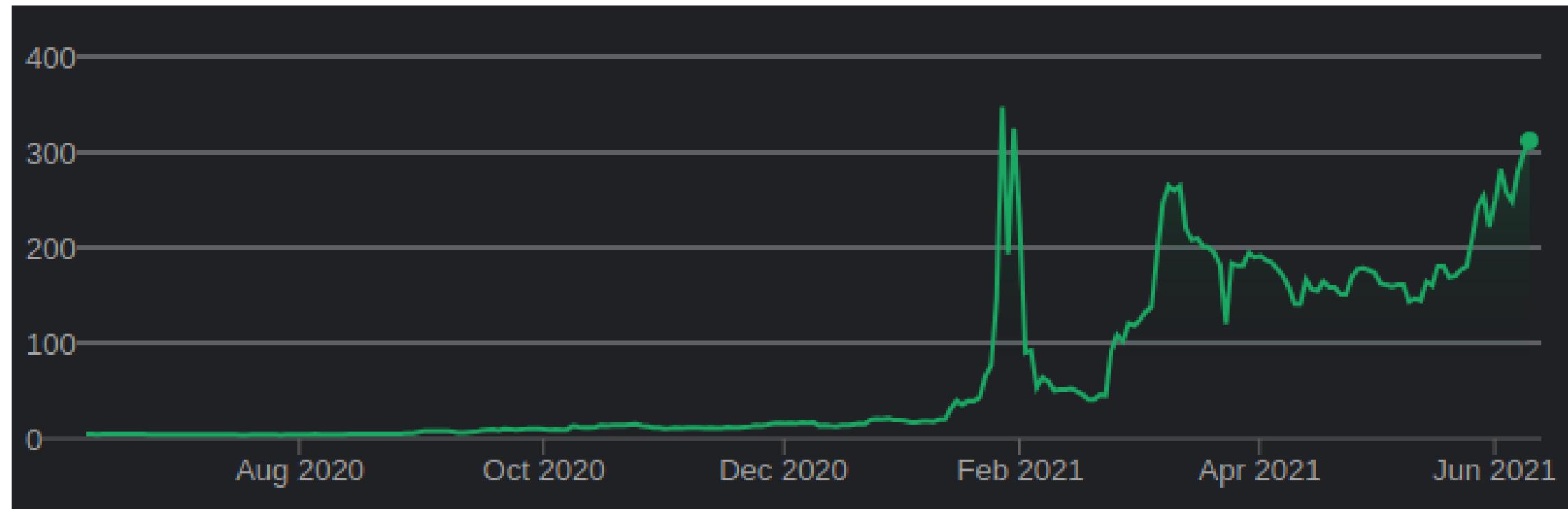


2

349

GME to the moon 🚀

Gain



- Gamestop (\$GME) is a physical retailer
 - Obscured by digital retailers
 - Historically low stock price (<\$10)
- Jan 2021 short squeeze peaked at \$347



r/wallstreetbets · Posted by

12 days ago



2

349

GME to the moon



Gain

/r/WallStreetBets

- Community of non-traditional stock traders
 - Glorifies losses
 - Jargon includes "degenerates", "ret****"
 - Meme heavy
 - Large user base
- /r/WSB attributed for meteoric \$GME rise
 - Wall Street hedge fund shorts \$GME
 - /r/WSB counters with a short squeeze
- Keith Gill (/u/deepf*****value) becomes a celebrity

About Community

...

Like 4chan found a Bloomberg Terminal

10.4m

Degenerates

135k

Buying FDs

Created Jan 31, 2012

Create Post

COMMUNITY OPTIONS

 85 Comments

 Award

 Share

 Save



829



"The recent trading in GameStop stock is a remarkable example of the power of the internet and electronic trading to democratize capital markets."

- Wall Street Journal opinion piece 05/02/2021

 133 Comments

 Award

 Share

 Save

...



Posted by u/

4 hours ago

85 Comments

Award

Share

Save



829



Research Questions

- Was GME a mass phenomenon or were there some big 'sharks'?
- Can we measure the effect of r/WSB on real stock prices?

133 Comments

Award

Share

Save

...



Posted by u/

4 hours ago



r/wallstreetbets · Posted by

12 days ago



2

349

GME to the moon



Gain

Financial Background

Stock traders

- Gain when prices rise
- Betting for price rise

Short contracts are different:

- Shorts gain money when prices fall
- Betting for price fall
- Hedge funds shorted >100% of GMEs stocks

/r/WSB short squeeze:

- Redditors buy up stocks, force prices up



 85 Comments Award Share Save829


Characterization of Reddit dataset

- 637'395 users
- Posts from 31/12/2020 to 17/03/2021
 - Links/text, discussion/news/YOLO/memes/due diligence
 - 80,283 posts
- Comments on posts/other comments
 - 15,371,115 comments
- Moderated by "mods"
 - Remove policy-violating posts/comments
 - Users can report posts/comments
 - 58,000 "removed" posts

 133 Comments Award Share Save

...



Posted by u/

4 hours ago

829

Characterization of Reddit dataset

- Most users post low number of posts
 - <10 posts commonly.
- Massive explosion of activity in late January
- High fraction (up to 50%) memes

Fig 1: Distribution Link Flairs over Time

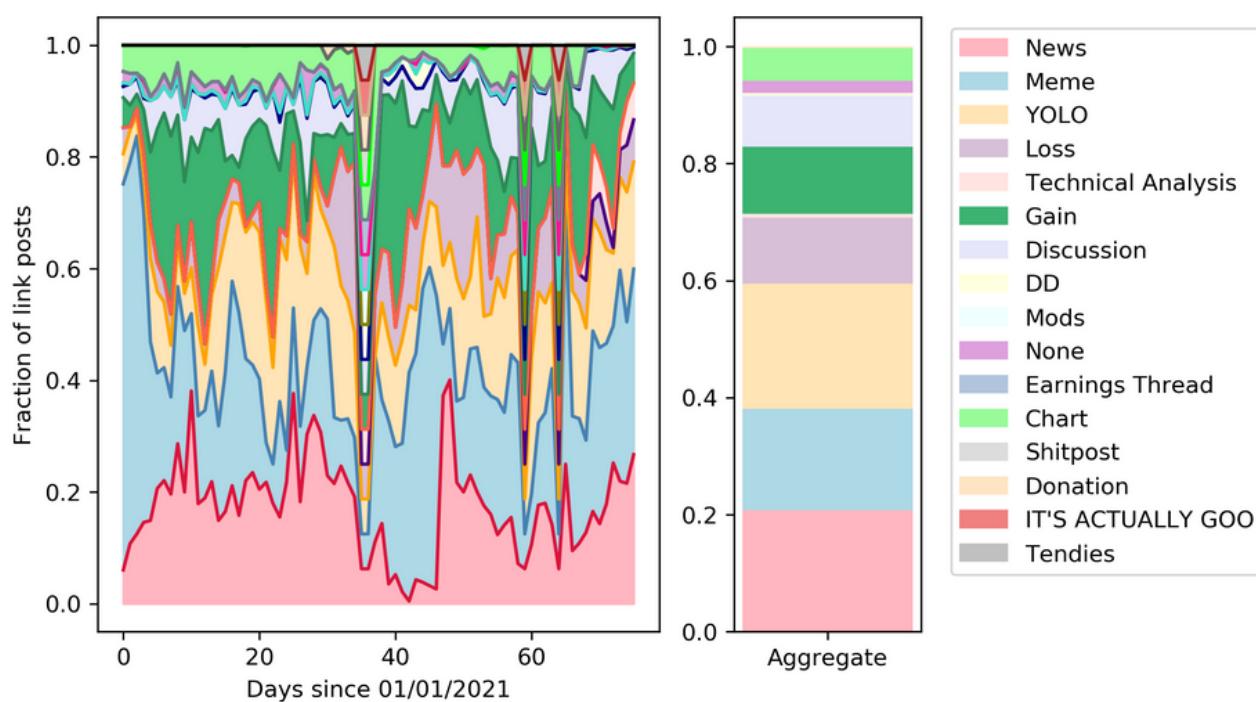


Fig 2: Post per User Distribution

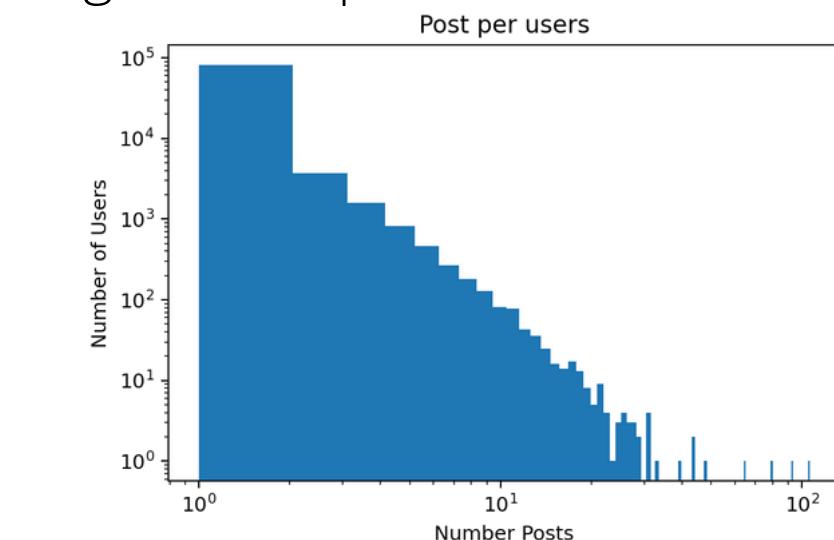
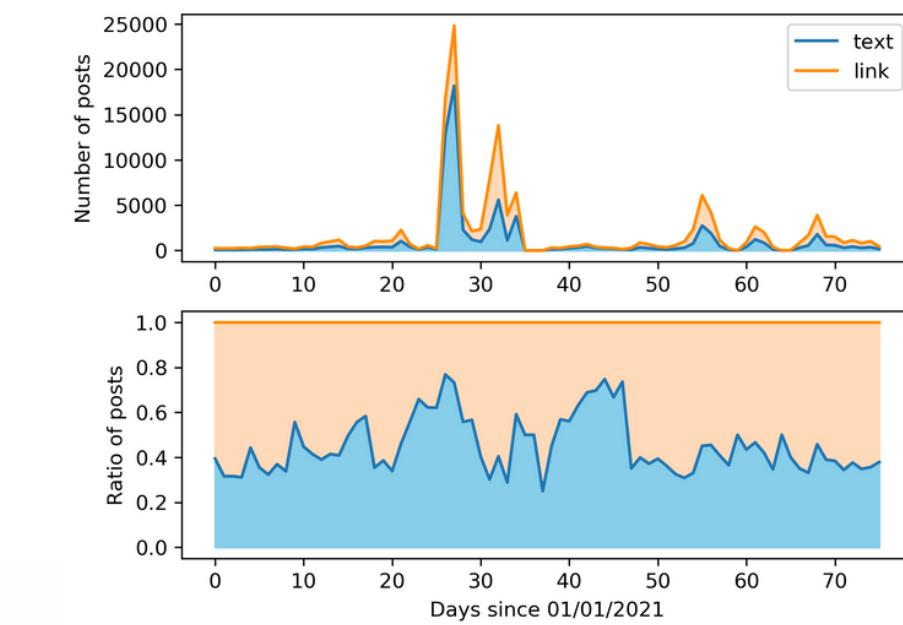


Fig 3: Link Text Posts over Time





r/wallstreetbets · Posted by

12 days ago



2

349

GME to the moon



Gain

Operationalizing mass phenomenon

1. Tight community structure
2. Quick communication channel
3. Many roles and key players



r/wallstreetbets · Posted by

12 days ago



2

349

GME to the moon



Gain

1. Tight community structure

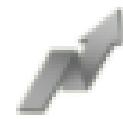
average degree: high

reciprocity: high

density: high

giant component

clustering coefficient: high



r/wallstreetbets · Posted by

12 days ago



2

349

GME to the moon



Gain

2. Quick communication channel

diameter: low

average shortest path: low

giant component: high



r/wallstreetbets · Posted by

12 days ago



2

349

GME to the moon



Gain

3. Many roles and key players

Different central nodes for different measures

Different roles among central nodes



829

Network overview

637395 users

2039746 comments on posts

3.20 comments per post

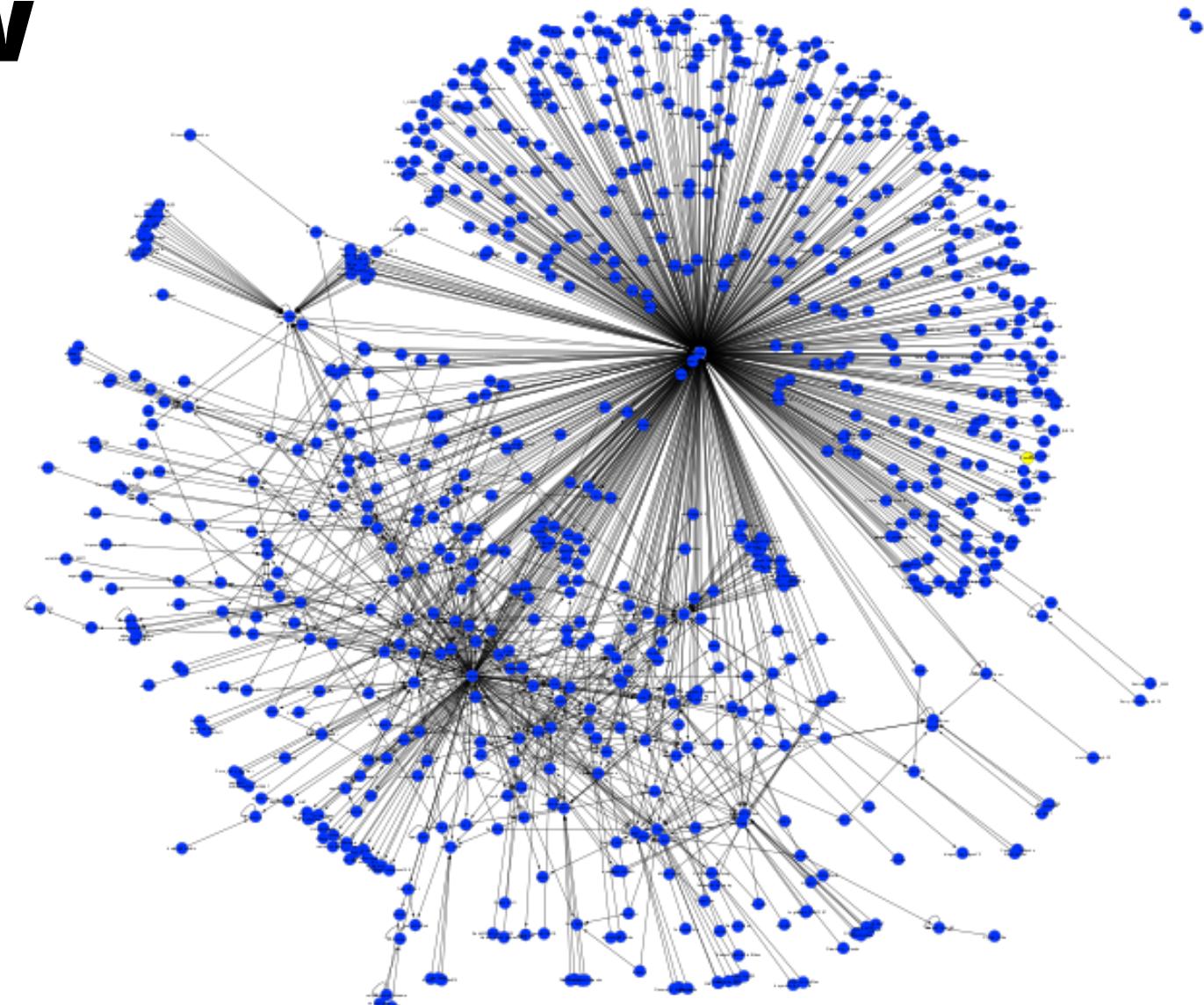
Subset:

30509 random users

103761 comments

3.40 comments per post

Fig 4: Network Huge Cluster





r/wallstreetbets · Posted by

12 days ago



2

349

GME to the moon



Gain

1. Tight community structure

average degree: 3.40

density: 0.01

reciprocity: 0.01

number of communities: 6626

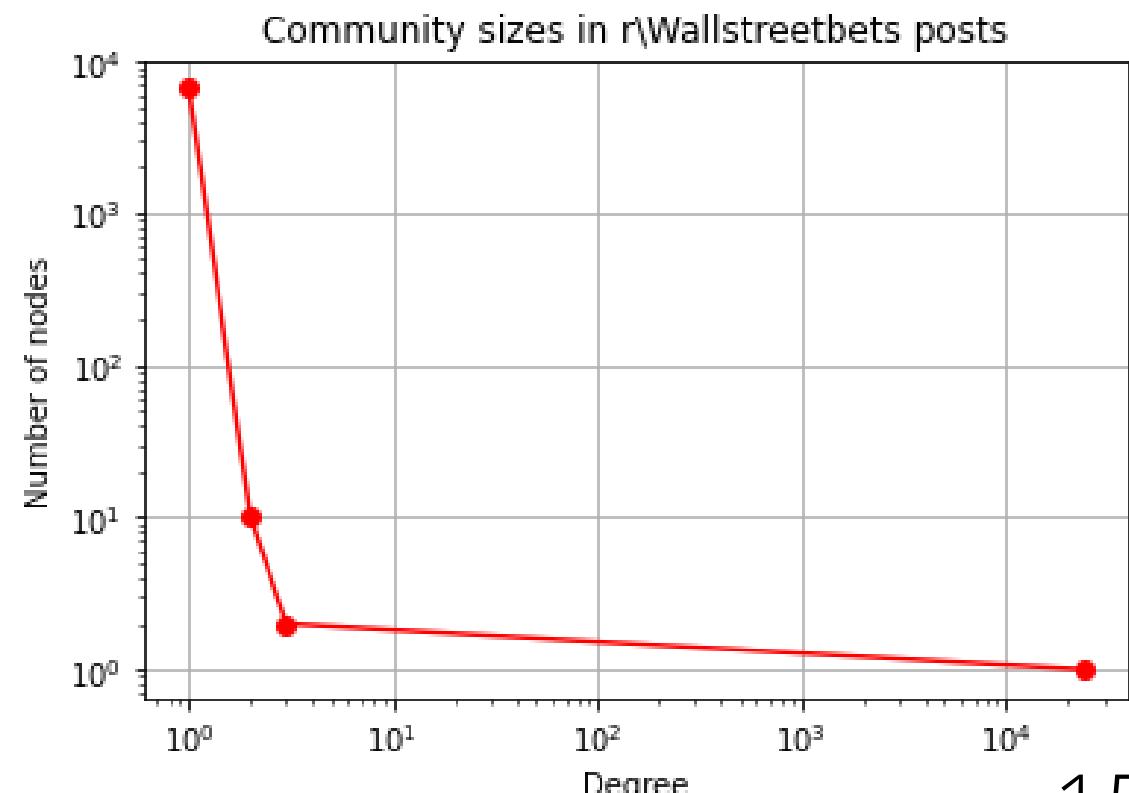
giant component: 23870 nodes

clustering coefficient: 0.23

Fig 5: Indegree Distribution



Fig 6: Community sizes distribution



Posted by **short squeeze pro** 14 hours ago 2 2 2 2 & 186 More

NOT EVERY STOCK IS A SHORT SQUEEZE [Discussion](#)

2.Quick communication channel

diameter: 8,
average shortest path: 2.67

2.4k Comments Award Share Save ...



Posted by u

short squeeze pro 14 hours ago & 186 More

28.3k

3. Many roles and key players

Betweenness

Closeness

OPINION_IS_UNPOPULAR,
AutoModerator,
MotorizedD*****Canoe,
theycallmeryan,
Bundaga,
speakinexistencebro,
Tradergurue,
LegalHelpNeeded3,
MIA4real,
Brilliant_Bet.

OPINION_IS_UNPOPULAR
AutoModerator,
MotorizedD*****Canoe,
zjz,
Tradergurue,
Unlucky-Prize,
MIA4real,
Tsukune_Surprise,
Smurhilicious,
SnooWalruses7854.

Message the mods

u/OPINION_IS_UNPOPULAR top notch guava fl...

u/CHAINSAW_VASECTOMY Get off my lawn

u/WallStreetBot BOT - Automod support

u/bawse1 Creator of WSBkid/Fuckboy...

u/zjz

u/VisualMod <http://wsb.gold>

u/premier_ Stronger than both of your mom's bf...

u/notmikjaash

u/WaterCups69 PussySlayer69

u/XvGTM17 Trades Maple Syrup Futures

[VIEW ALL MODERATORS](#)

GATEKEEPERS

VISIBLE FIGURES

Posted 33 hours ago 17 7 11 & 23 More 7.6k

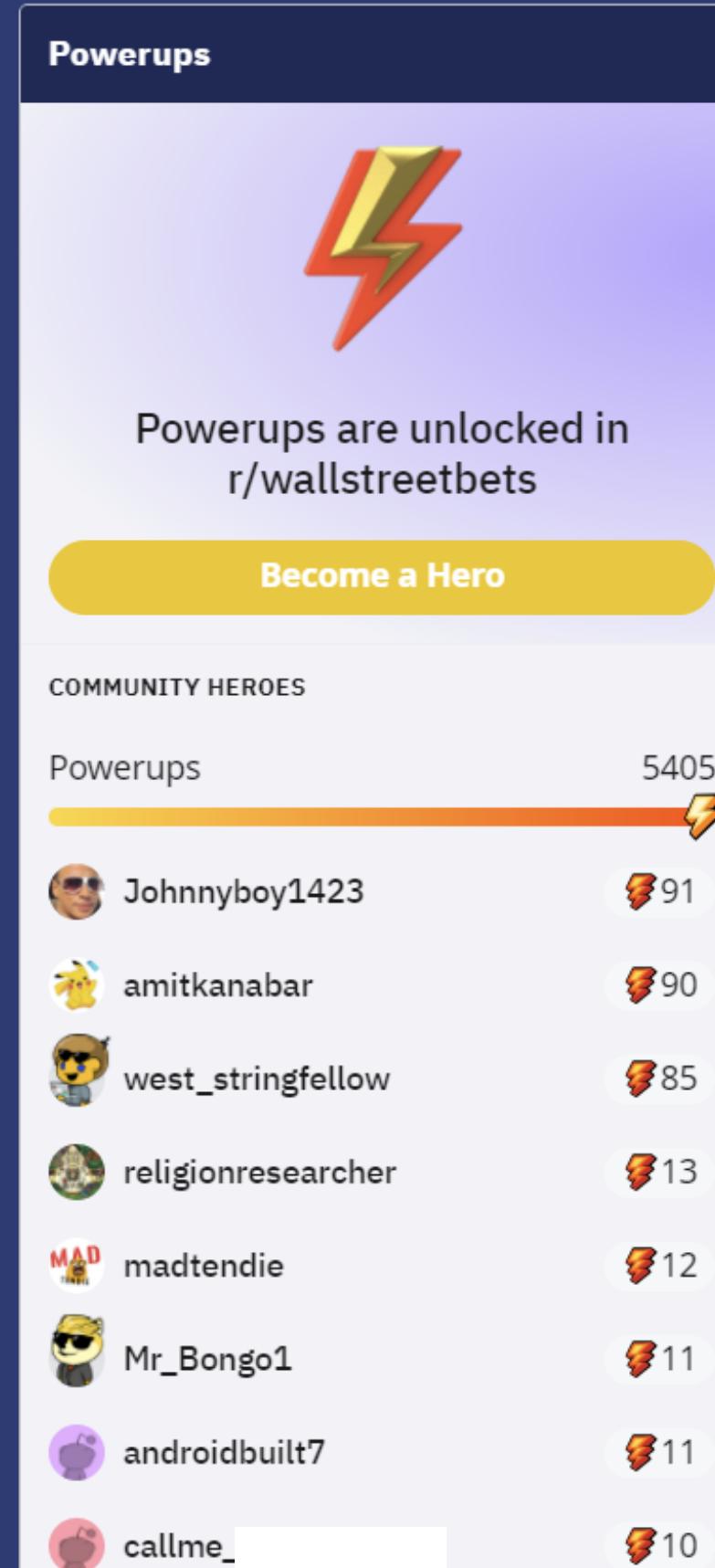
3. Many roles and key players

Authorities

OPINION_IS_UNPOPULAR, AutoModerator, MotorizedD****Canoe, theycallmeryan, zjz, Tradergurue, MIA4real, MortalDanger00, Tsukune_Surprise, Unlucky-Prize
(deepf*****value)

Hubs

MangoManYummy, nosalute, giantwashcapsfan8, FaithlessnessFree331, disneysinger, badgerbacon6, sveltepants, sonofalando, good-times, mikemechanics



Authorities

GME Q1 Earnings
Megathread

its the WSB bot
[/u/theycallmeryan](#)

HF's are loading up big on
CLOV shares DD

We made the Q4 2020
GME earnings call the
hottest event of the
year

Hubs

I'm scared

GME

Closed my gamestonk put for
-50%, doesn't seem to go down
any time soon

Inflation getting out
of control

Powerups



Powerups are unlocked in
r/wallstreetbets

[Become a Hero](#)

COMMUNITY HEROES

Powerups	5405
 Johnnyboy1423	⚡ 91
 amitkanabar	⚡ 90
 west_stringfellow	⚡ 85
 religionresearcher	⚡ 13
 madtendie	⚡ 12
 Mr_Bongo1	⚡ 11
 androidbuilt7	⚡ 11
 callme_	⚡ 10

85 Comments

Award

Share

Save



829



Methods: Inference

Overview:

- Regression Features
- Time shift
- OLS

133 Comments

Award

Share

Save

...



Posted by u/

4 hours ago

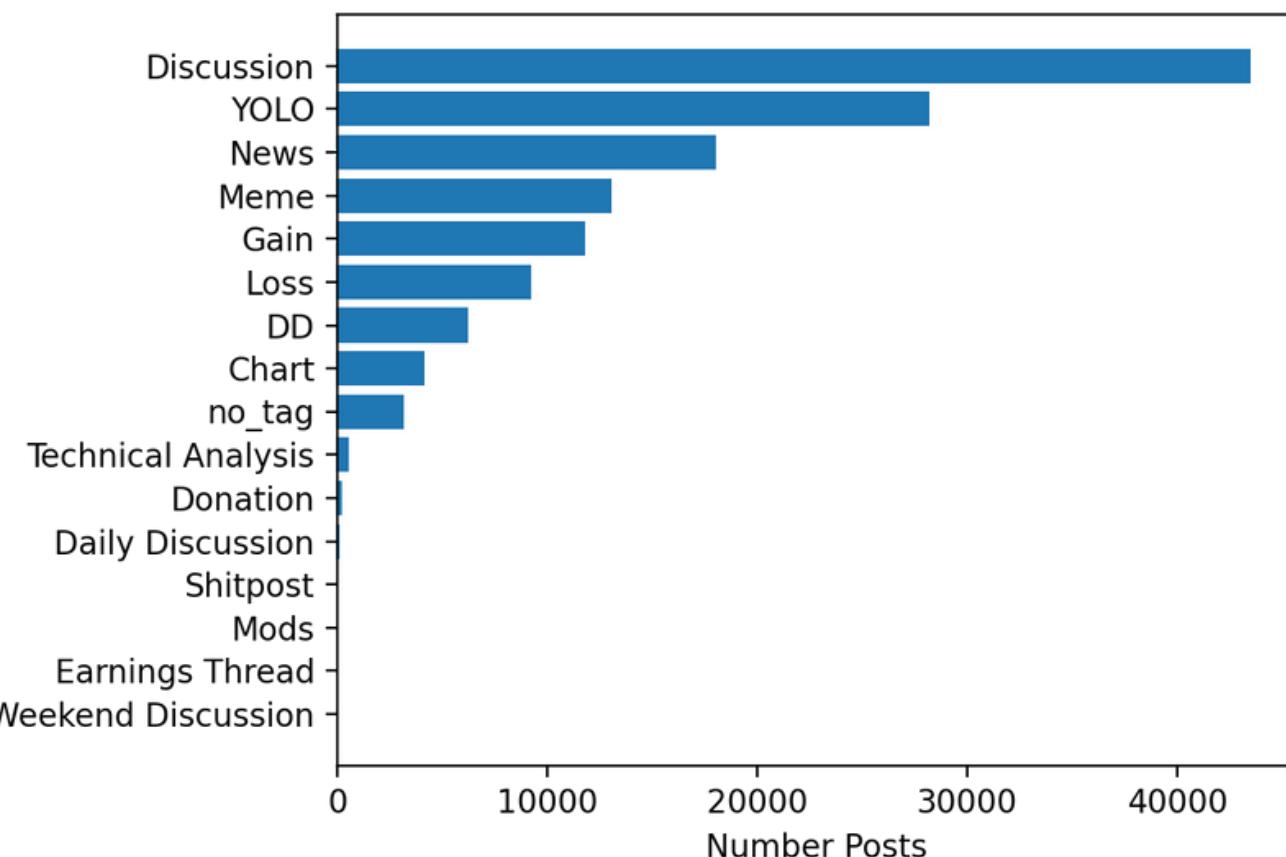
20



Methods: Regression Features

- Selected posts containing ['gamestop', 'gme', '\$gme'] in title
- Differentiate between different post Topics (Discussion vs. Reaction)
- Weight posts according to different metrics (number of comments, score, up-vote ratio, NLTK vader sentiment)
- Time Fixed Effects: weekend & night

Fig 7: Topic distribution posts





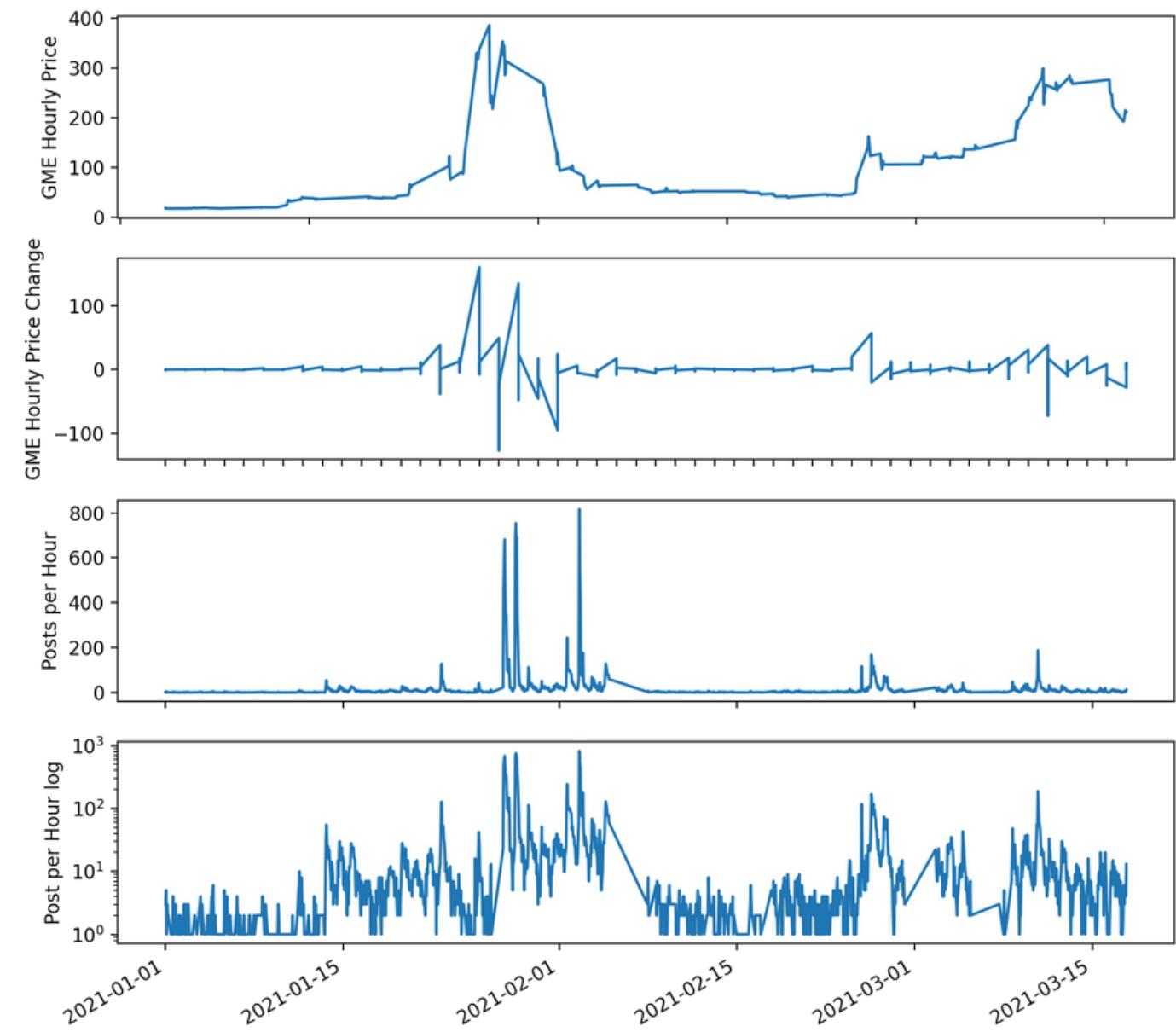
829



Methods: Time Shift

- We measure the effect of posts mentioning GME on the change in stock price in the next hour
- Time series was tested to be stationary
- We use a 'lag' or time shift of one hour
 - Effect of post activity on change in price in one hour

Fig 8: Time series of a) GME price, b) price change, c) post per hour, d) log of post per hour



133 Comments



Award



Share



Save

...



Posted by u/

4 hours ago



829



Methods: Regression

OLS formula: GME hourly price change OLS specification

$$\Delta GME Price_{i,t+1} = \beta_0 + \beta_1 Discussion_{i,t} + \beta_2 Reaction_{i,t} + \beta_3 Comments_{zNorm,i,t} * Discussion_{i,t} + \beta_4 Comments_{zNorm,i,t} * Reaction_{i,t} + \beta_x X_{i,t} + e_{i,t}$$

- Effect of post activity on change in price in one hour
- Number of discussion & reaction post in preceding hour
- Interacted with z-normalized number of comments
- Covariates (Time fixed effects, post score, sentiment of title, etc.)



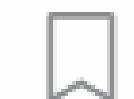
133 Comments



Award



Share



Save

...



Posted by u/

4 hours ago



Results: Regression Table

	Dependent Variable: Hourly Change in Stock Price GME (N=350)			
	GME Mentions	Differentiation of Post type	Differentiation of Post importance	Differentiation of Post importance incl. Covariates
GME Posts	0.0092*** (0.003)			
GME Discussion Posts		0.1686** (0.027)	0.9120*** (0.000)	0.6975*** (0.000)
GME Reaction Posts		-0.0830** (0.016)	-0.4741*** (0.000)	-0.3610*** (0.002)
Comments z-Normalized			-0.0890 (0.918)	-0.0621 (0.943)
Comments z-Normalized *GME Discussion Posts			2.7308*** (0.000)	2.0279*** (0.003)
Comments z-Normalized *GME Reaction Posts			-1.4197*** (0.000)	-1.0802*** (0.005)
Weekend/Night Fixed Effects	✓	✓	✓	✓
Other Covariates	✗	✗	✗	✓
Df Model	3	4	7	13
R-squared	0.057	0.147	0.203	0.230
Adj. R-squared	0.049	0.137	0.186	0.200
F-statistic	7.020	14.81	12.41	7.702

Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 1:
Regression Table



829



Results: Discussion

- Posts mentioning GME seem to have a significant effect on hourly changes in the GME stock price
- Depending on the topic of a post, posts seem to have a different effect on the change in stock price
 - Discussion posts significantly correlate with an increase in price
 - Reaction post significantly correlate with a decrease in price
- Additional features of a post, seem to explain additional variance
 - The amount of discussion on a given post seem to reinforce given effects



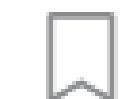
133 Comments



Award



Share



Save

...



Posted by u/

4 hours ago



Limitations

- Data collection
 - Large data set with 900k posts, truncated to remove low-scores
 - Misses ongoing trends as the saga continues
- Network:
 - could not run on full network
 - no edge weights, no comments on comments
 - difficult comparison of the measures
- Inference
 - Correlation is not causation! (Extend with IV Regression)
 - Features might be ill constructed
 - Further investigate, what comments contain





829



Conclusions

- Was GME a mass phenomenon or were there some big 'sharks'?
→ Very well connected and big community, dominated by many rather than by few
- Can we measure the effect of r/WSB on real stock prices?
→ Posts predate and significantly correlate with GME stock price



85 Comments

Award

Share

Save



829



Lessons Learned

- Large-scale data collection is challenging
- Analysis of real-life networks is computationally-intensive
- Regressions with time series are complicated
- Look closely at community to understand it

133 Comments

Award

Share

Save

...



Posted by u/

4 hours ago

28

85 Comments

Award

Share

Save



829



Additional Slides

133 Comments

Award

Share

Save

...



Posted by u/

4 hours ago

28

GME Q1 Earnings
Megathread

its the WSB bot
[/u/theycallmeryan](#)

HF's are loading up big on
CLOV shares DD

We made the Q4 2020
GME earnings call the
hottest event of the
year

Authorities

[OPINION_IS_UNPOPULAR](#),
[AutoModerator](#),
MotorizedD****Canoe,
[theycallmeryan](#),
[zjz](#),
Tradergurue,
MIA4real,
MortalDanger00,
Tsukune_Surprise,
Unlucky-Prize

(deepf*****value)

Hubs

MangoManYummy,
nosalute,
giantwashcapsfan8,
FaithlessnessFree331,
disneysinger,
badgerbacon6,
sveltepants,
sonofalando,
good-times,
mikemechanics

Powerups



Powerups are unlocked in
r/wallstreetbets

[Become a Hero](#)

COMMUNITY HEROES

Powerups	5405
	Johnnyboy1423 91
	amitkanabar 90
	west_stringfellow 85
	religionresearcher 13
	madtendie 12
	Mr_Bongo1 11
	androidbuilt7 11
	callme_ 10

7.6k
7.6k

Authorities

OPINION_IS_UNPOPULAR,
AutoModerator,
MotorizedDoucheCanoe,
theycallmeryan,
zjz,
Tradergurue,
MIA4real,
MortalDanger00,
Tsukune_Surprise,
Unlucky-Prize

(deepf*****value)

Hubs

MangoManYummy,
nosalute,
giantwashcapsfan8,
FaithlessnessFree331,
disneysinger,
badgerbacon6,
sveltepants,
sonofalando,
good-times,
mikemechanics

I'm scared
GME

Closed my gamestonk put for
-50%, doesn't seem to go down
any time soon

Inflation getting out of control